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(54) Name of the invention: Electret Filter

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Patent Assignees:

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Mitsui Petrol Chemical Company

[Note : Names, addresses, Company names and brand names are translated in the most common manner. Japanese Language does not have singular or plural words unless otherwise specified with numeral prefix or general form of plurality suffix. Translator's note.]

Description of the invention

1. Name of the invention

Electret Filter

2. Range of the claims of the invention

1. Electret filter, that has a structure formed by using as its main material a laminated layer product where, the structure is formed as an electretized macromolecular (polymeric) film is stacked in the direction of the thickness as an electroconductive sheet is inserted in between.

2. Electret filter, that has as its main material a horizontal layer product where, an electret film is continuously bent or folded, and over the whole surface of the film wrinkles are formed and a thickness is acquired and together with that a large number of connected air paths are formed, and this electretized film with the formed on it wrinkles is horizontally stacked as an electroconductive sheet is inserted in between, and the front edges of the wrinkles are adhered or melt adhered onto the film surface.

3. Detailed explanation of the invention

The present invention is an invention about an electret filter, that is used in order to remove the fine (microscopic) particles, that are mixed in a gas material or a liquid material, with the goal to purify the air, dust collection, and removal, etc.

As an equipment that is used in order to purify air by eliminating the tobacco smoke or dust etc., from the air, already, the equipment where dust is electrically eliminated, and the electrostatic filter, etc., have been used. However, in the case of these devices, the equipment costs are high, and not only that, but also, there are the drawbacks that it is said that the working life, where an effective flowing capability is

maintained, is short.

Regarding the present invention, it is an invention where in order to eliminate these drawbacks an electret filter is suggested where an electretized macromolecular film is used as the filter, that has excellent dust collection capability and also that has a long working life.

Regarding the present invention, it is an invention about an electret filter, that has as its main material a laminated layer product where, an electretized macromolecular film is stacked in the direction of the thickness as an electroconductive film is inserted in between. And also, the present invention is an invention about an electret filter, that has as its main material a horizontal layer product where, an electret film is continuously bent or folded, and over the whole surface of the film wrinkles are formed and a thickness is acquired and together with that a large number of connected air paths are formed, and this electretized film with the formed on it wrinkles is horizontally stacked as an electroconductive sheet is inserted in between, and the front edges of the wrinkles are adhered or melt adhered onto the film surface.

Regarding the macromolecular material that is used according to the present invention, it is a good option if it is a material that can be obtained by the melt molding method, the flow- extension method, the cutting method etc., and for example, it is possible to use polyolefin resin, polyester resin, polyamide resin etc., thermoplastic resins, phenol resin, formaldehyde resin, urea - formaldehyde resin, melamine - formaldehyde resin, etc., thermo setting resins. Among these resin materials, besides the polyethylene, polypropylene, poly - 4- methyl - 1- pentene, polystyrene, etc., polyolefin resins, that have excellent electret performance, also, polyethylene terephthalate, etc., polyester resins and polycarbonate resin, are preferred. And these resins include the materials that are compounded with or graft polymerized with unsaturated carboxylic acids or their derivative materials.

Also, in these resin materials, depending on the requirements, it is also possible to compound the well known from the previous technology, stabilization agents, for example, anti-oxidation agents, thermal resistance stabilization agents.

Regarding the macromolecular film material, usually, it is produced at a thickness that is within the range of approximately 3 microns ~ 3 mm, and depending on the requirements, it is uniaxially or biaxially oriented. In the case of this macromolecular film material, it is also a good option if it is a foamed material or a material that has porous properties, and it is also a good option if it is a material that has been subjected to a crosslinking treatment, and it is also a good option if it is a nonwoven fabric type film, and it is also possible to use a material where 2 or more layers have been layer laminated. The macromolecular film material is electretized according to the different well known methods, like for example, the thermal electretization method, the electro-electretization method, the radio- electretization

method, the mechano - electretization method, the magneto - electretization method, the hot electretization method, etc. In the case of this electretization treatment, depending on the goal, it can be conducted at the same time with the film formation, or before or after that. As the electroconductive sheet that is used according to the present invention, it is possible to use aluminium foil, metal net, electroconductive plastic material, metal vapor deposited plastic etc.

After that, the practical examples according to the present invention will be explained based on the diagrams presented. In the case of the Practical Example 1, that is shown in Figure 1, the electretized film 1 is continuously bent in a mountain type shape, and over the whole surface of the film, the wrinkles 2, are formed, and a thickness is obtained, and together with that, a large number of triangular prism shape continuous air paths 3, are formed, and this electretized film 1 that has the imparted on it wrinkles, is stacked in the direction of the thickness, as an electroconductive sheet 4 is inserted in between, and also, on the bottom side also, the electroconductive sheet 4 is added, and the front edges of the wrinkles are adhered or melt adhered onto the electroconductive sheet 4, and the product 5 is obtained that has a structure formed as layers of electret film that has imparted on it wrinkles are stacked where an electroconductive sheet is placed in between them.

In the case of the Practical Examples 2 that is shown in Figure 2, an electret film 6 is folded so that a continuous pile is formed, and over the whole surface of the film, the wrinkles 7 are formed, and a thickness is obtained, and together with that, a large number of deformed cylinder air pathways 8, is formed, and then this electret film 6, with the imparted on it wrinkles, is stacked in the direction of the thickness, as an electroconductive sheet 9 is inserted in between, and also, on the bottom side also, an electroconductive sheet 9 is added, and the partitioning pieces 9', that are provided on each electroconductive sheet, so that it is protruding, is inserted inside the continuous air pathways 8, and the front edges of the wrinkles are adhered or melt adhered onto the electroconductive sheet 9, and the structure of the product 10 of laminated layers of electret film that has imparted on it wrinkles, is formed.

In the case of the Practical Example 3 that is shown according to Figure 3, the electret film 11 is continuously folded along the length, and over the whole surface of the film, the wrinkles 12 are formed, and by that a thickness is obtained and together with that, a large number of the polygonal prism shaped continuous air pathways 13, are formed, and this imparted with wrinkles electret film 11 is stacked in the direction of the thickness as an electroconductive sheet 14 is placed in between, and the front edges of the wrinkles are adhered or melt adhered onto the electroconductive sheet 14, and by that the structure of the laminated layer product 15, obtained from an electret film material with wrinkles imparted on it, is formed.

In the case of the product 5, that is formed from laminated layers of such electret film material, regarding the surface electrical potential of the electroconductive sheet 4, as it is shown in Figure 4, the different polarities are facing each other, or as

it is shown according to the presented in Figure 5, the same polarities are facing each other. The same is true regarding the electret laminated layer products 10 and 15, obtained according to the Practical Examples 2 and 3.

Figure 6 is a figure in order to show one detailed example of the filter, and in that case, in the box 16, that has been cut open on both the front and the back surface, the laminated layer product 5, that is formed from the imparted with wrinkles electret filter, is inserted, and the air that is being purified is flowing in the direction from the front to the back surface of the box 16, and it passes through the continuous air pathways 3.....

Regarding the present invention, as it has been shown according to the Practical Examples 1 ~ 3, it is an invention that has as the main materials of the filter, the laminated layer product 5 , 10, and 15, that are formed as the electretized film is continuously bent or folded and over the whole surface of the film, the wrinkles 2, 7, and 12, are formed, and this imparted with wrinkles electret film 1, 6, 11 is correspondingly stacked in the direction of the thickness, so that the front edges of the wrinkles are adhered or melt adhered onto the electroconductive sheet 4, 9, 14. And then, the air that is being purified is flowing in the direction of the wrinkles and it passes through the continuous pathways 3, 8 and 13.

According to the present invention, a laminated layer product obtained as an electret film is stacked so that an electroconductive sheet is inserted in between, is used as the main material of the filter, and the surface potential of the electroconductive sheet can be so that different poles are facing each other, or that the same poles are facing each other, and in both cases, the dust collection efficiency is significantly increased and also the working life becomes significantly longer. And especially, in the case when the same poles are mutually facing each other, its structure is obtained by the folding of a long length film material, and because of that manufacturing operations become easy. Also, according to the present invention, the contact surface area of the air and the electret film, is increased, and because of that, the dust collection efficiency is increased, and because the air is flowing easily, there is little loss of pressure, and also, because in the case of the the imparted with wrinkles electret film, the front edges of the wrinkles are adhered or melt adhered, there is no deviation from the shape, and during the use, there is no fluttering, and due to that, there is no volatilization of the adhered dust material, and because of the cooperation of all of these factors, a filter is obtained that has excellent collection performance and also, that has a long working life.

When the filter according to the present invention is compared to a filter where an electroconductive sheet has not been inserted, the results obtained are according to the presented in Table 1.

Table 1

表 1

		1 本発明		2 導電性シートなし			
		3 異極	4 同極	3 異極		4 同極	
				折曲げ	平坦	折曲げ	平坦
7 圧力損失 (20 mm/g)		0	0	0	0	0	0
8 効率 (0.3 μm, %)	9 初期	750	740	560	450	350	155
	10 時間経過後	745	740	557	240	200	120

Headings in the table:
1. Present invention, 2. there is no electroconductive sheet, 3. different poles, 4. same poles, 5. bent, 6. flat, 7. pressure losses (20 cm/g), 8. efficiency (0.3 microns, %), 9. initial, 10. after the passing of the time.

As it becomes clear from the presented in this Table 1, there is no relationship between the presence or absence of an electroconductive sheet and the pressure loss, however, in the case of the present invention, the initial efficiency and together with that the efficiency after the passing of time, are high, and there is almost no difference between those two efficiencies, and because of that, it is understood that the working life of the filter obtained according to the present invention, has a significant duration.

According to the present invention, a product obtained from the laminated layer structure of electret film with an electroconductive sheet inserted in between, is used as the main material of the filter, and because of that, there are the results that the dust collecting efficiency is significantly increased, and that the duration of the working life is also significantly lengthened. And then, in the case according to the present invention, it has many effects such that because at the time of use there is no fluttering, there is no volatilization of the adhered dust material, and the pressure losses are extremely small, and because of that, it is possible to reduce the energy, and also, because the contact surface area is wide, the dust collection efficiency is high, and both the initial efficiency and the efficiency after the passing of the time, are excellent, etc.

4. Simple explanation of the figures

Figure 1, Figure 2 and Figure 3 are correspondingly front surface diagrams showing the Practical Examples 1, 2 and 3 according to the present invention. And Figure 4 and Figure 5, are diagrams explaining the surface electrical potential of the electroconductive sheet. Figure 6 is a three-dimensional diagram that shows a detailed example of the filter.

Moreover, 1, 6 and 11 represent the imparted with wrinkles electret film, 2, 7 and 12 represent the wrinkles, 3, 8 and 13 represent the continuous air pathways, 4, 9 and 14 represent the electroconductive sheet.

Patent Assignees:

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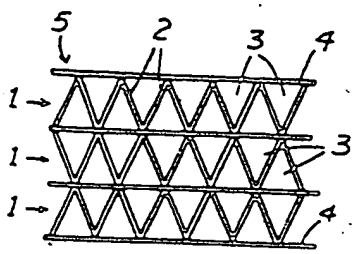
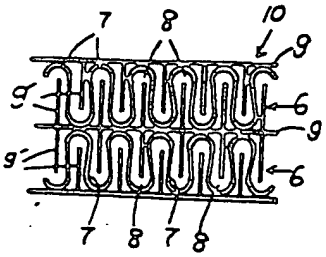
Translated by Albena Blagev (735-1461 (h), 704-7946 (w))

10/13/98



第1図



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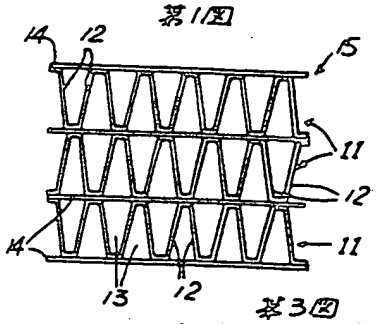

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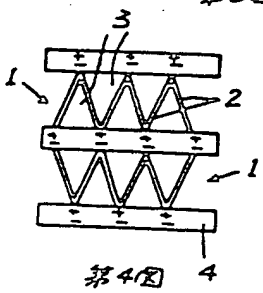

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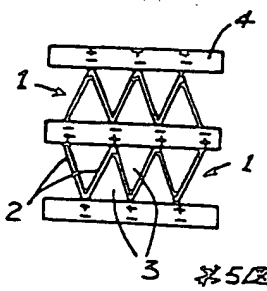

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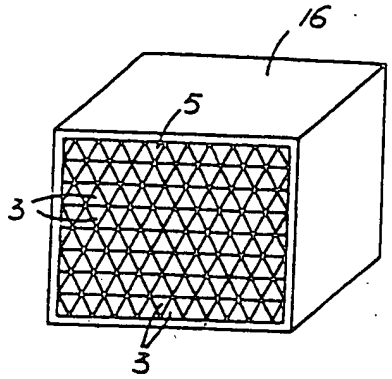

第6図